

SS 1608B DCS/ ECS SAT INSTALLATION AND CHECK OUT PROCEDURE

SATORP Jubail Export Refinery Project

Invensys Ref: ME85009
Invensys Process Systems

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SS 1608B ECS SAT INSTALLATION AND CHECK OUT PROCEDURE

REVISION HISTORY

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00	06-Jan-2012	Issued for Acceptance

HOLDS LIST

HOLD NUMBER	SECTION	DATE ENTERED	CHANGE ORDER NUMBER	DESCRIPTION	DATE CLEARED

Reference Documents

Invensys Documents

2271-PCS-PRJ-002	PCS System Development Plan
2271-PCS-PRJ-005	PCS Project Quality Plan
2271-PCS-FDS-001	PCS Networks & Cyber Security FDS
2271-PCS-FDS-002	PCS Cabinets FDS
2271-PCS-FDS-003	TMR Systems – ESD, FGS & CCS FDS
2271-PCS-FDS-004	PCS Communication Interfaces FDS
2271-PCS-FDS-005	PCS Database Structure and Transfer Methodology FDS
2271-PCS-FDS-006	DCS & ECS Systems FDS
2271-PCS-FDS-007	Operator Training Simulator FDS
2271-PCS-FDS-008	Machine Condition Monitoring FDS
2271-PCS-FDS-009	Process Monitoring CCTV FDS
2271-PCS-FDS-010	PCS Alarm Management FDS
2271-PCS-FDS-011	Blending and Material Movements - Refinery Offsite Management Solution Suite FDS
2271-PCS-FDS-012	PCS Asset Management FDS
2271-PCS-FDS-013	PCS Human Interface FDS
2271-PCS-FDS-014	DAHS, PCS Historian and Reports FDS
2271-PCS-FDS-015	Maintenance Training System FDS
2271-PCS-FDS-016	PCS Integrated Control Software FDS
2271-PCS-FDS-017	Advanced Process Control FDS
2271-PCS-FDS-018	Pipe Line Monitoring and Control FDS
2271-PCS-FDS-019	ESD TMR Systems FDS
2271-PCS-FDS-020	F&G TMR Systems FDS
2271-PCS-FDS-021	CCS TMR Systems FDS
2271-PCS-FDS-022	PCS Control Strategies FDS
2271-PCS-PHC-001	PCS Power & Heat Calculation Template.
2271-PCS-ITP-001	PCS FAT and IFAT Plan
2271-PCS-ITF-001	Inspection and Test Form Template – DCS and ECS Systems
2271-PCS-ITF-002	Inspection and Test Form Template – TMR systems
2271-PCS-ITF-003	Inspection and Test Form Template – MMS Systems
2271-PCS-ITF-004	Inspection and Test Form Template – CCTV Systems
2271-PCS-ITF-005	Inspection and Test Form Template – OTS and BLM Systems

Invensys Drawings

2271-PCS-ARC-001	PCS Architecture
2271-PCS-ARC-002	PCS Network Drawings
2271-PCS-CAB-001	PCS Cabinet Drawings
2271-PCS-CAB-002	PCS Cabinet Block Diagram
2271-PCS-TWS-001	PCS Typical Wiring Schematics
2271-PCS-TIW-001	PCS Typical Internal Wiring Schematics

Jubail Export Refinery Engineering Standards

JERES-B-058	Emergency Shutdown, Isolation and Depressuring
JERES-J-003	Basic Design Criteria
JERES-J-005	Instrument Drawings and Forms
JERES-J-601	Emergency Shutdown and Isolation Systems
JERES-J-602	BMS, Combustion and Waterside Control Systems for Water Tube Boilers
JERES-J-603	Process Heater Safety Systems
JERES-J-604	Protective & Condition Monitoring Eq. for Rotating Machinery
JERES-J-801	Control Buildings
JERES-J-902	Electrical System for Instrumentation
JERES-J-903	Intrinsically Safe System
JERES-P-127	Electrical Control System
JERES-T-625	Inter & Intra Building Fibre Optic Communication Cables
JERES-Z-001	Process Control System
JERES-Z-003	Pipeline Leak Detection Systems
JERES-Z-010	Process Automation Networks Connectivity

Jubail Export Refinery Materials Specifications

JERMS-J-4623	Programmable Controller Based ESD Systems
JERMS-J-4625	Machinery Protection System
JERMS-J-4634	Local ZV Control Systems
JERMS-J-4716	Pneumatic Actuators On-Off Service
JERMS-J-4813	Instrumentation & Thermocouples Cables
JERMS-J-4820	Instrument Control Cabinets – Indoor
JERMS-T-8625	Fibre Optic Cable Specification
JERMS-Z-3010	Distributed Control System
JERMS-Z-3020	Supervisory Control and Data Acquisition (SCADA) Systems
JERMS-Z-3030	Remote Terminal Units

Jubail Export Refinery Engineering Procedures

JEREP-111	Instrument Database Management
JEREP-112	SmartPlant Instrumentation User Guide
JEREP-200	Document Management & Final Documentation Requirements
JEREP-624	Preparation of System Design Documents
JEREP-626	Configuration and Graphics Guidelines
JEREP-634	Factory Acceptance Test
JEREP-636	Installation and Checkout Plan
JEREP-638	Site Acceptance Test
JEREP-640	Process Automation Networks & Systems Security

Jubail Export Refinery Project Procedures

2271-AAA-JSM-201	Item Numbering and Coding Procedure
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General Design Rules (Job Specification – Design)

2271-AAA-JSD-1500-01	JSD for Instrumentation & Automation (Guidelines for EPC Bidding)
2271-AAA-JSD-1500-02	JSD for Instrumentation & Automation
2271-AAA-JSD-1501-01	JSD for Instrument Numbering
2271-AAA-JSD-1522-01	JSD for Instrument/ Electrical Interface
2271-AAA-JSD-1540-01	JSD for Instrumentation
2271-AAA-JSD-1560-01	JSD for Analyzer Maintenance and Data System (AMDS)
2271-AAA-JSD-1570-01	JSD for Installation and Testing of Instr. & CTRL Systems
2271-AAA-JSD-1580-01	JSD for Packages Instrumentation
2271-AAA-JSD-1900-03	Design Safety Concept
2271-701-JSD-1510-01	JSD for Control & Safety System Philosophy
2271-701-JSD-1510-02	JSD for Control & Safety System Philosophy for OSBL Marine Terminal
2271-701-JSD-1510-03	JSD for Asset Management System (AMS)
2271-701-JSD-1510-04	JSD for Data Acquisition and Historization System (DAHS)
2271-701-JSD-1510-05	JSD for Maintenance Training Simulator (MTS)
2271-701-JSD-1510-07	JSD for Alarm Management System (ALMS)
2271-701-JSD-1518-02	JSD for Operator Training Simulator (OTS)

General Supply Rules (Job Specification – Supply)

2271-701-JSS-1510-01	JSS for PCS Functional Specification
2271-701-JSS-1510-02	JSS for PCS Vendor Services
2271-701-JSS-1510-03	JSS for PCS Configuration Guidelines
2271-701-JSS-1515-01	JSS for ESD System
2271-701-JSS-1515-02	JSS for CCS System
2271-701-JSS-1515-03	JSS for Process Closed Circuit Television System (CCTV)
2271-701-JSS-1515-04	JSS for Fire & Gas System
2271-AAA-JSS-1516-01	JSS for Tank Gauging System (TGS)
2271-AAA-JSS-1563-01	JSS for Corrosion Monitoring System (CRMS)

General Supply Rules (Job Specification – Drawings)

2271-701-DW-1512-001	ISBL Control and Safety Systems Connection Diagram
2271-701-DW-1512-002	PCS Architecture Block Diagram
2271-701-DW-1512-003	ISBL FO Cable Block Diagram
2271-701-DW-1512-005	PCS Architecture Block Diagram OSBL
2271-701-DW-1512-006	OSBL FO Cable Block Diagram
2271-701-DW-1522-001	Instrument Power Supply Distribution Typical Single Line Diagram

Non Material (NM Specification)

2271-AAA-NM-1500-01	Instrumentation & Control System EPC Contractors Responsibility Matrix
2271-AAA-NM-1500-02	Instrumentation & Control System EPC Contractors Cabling Interface Points

Reference Web Sites

- Invensys Triconex System – www.triconex.com/
- Invensys Foxboro I/A System – www.foxboro.com/
- FDT Group – www.fdtgroup.org

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Glossary

General project abbreviations and system terminology are listed below, with specific abbreviations identified in the text of each section.

ALMS	Alarm Management System
AMDS	Analyser Maintenance and Data System
AMS	Asset Management System
APM	Advance Process Monitoring
BLM	Basic Learning Model
BOSS	Blend Optimisation and Supervisory System
BPD	Barrels Per Day
BPO	Blend Plan Optimisation
BTM	Batch Tracking Manager
C&E	Cause and Effect
CCS	Compressor Control System
CCTV	Closed Circuit Television
CDR	Critical Design Review
DAHS	Data Acquisition and Historian System
DCS	Distributed Control System
DDS	Detailed Design Specification
ECS	Electrical Control System
EPC	Engineering Procurement Construction
ESD	Emergency Shutdown System
CCS	Fire and Gas
FAT	Factory Acceptance Test
FDS	Functional Design Specification
FEED	Front End Engineering Design
FGS	Fire and Gas System
FOB	Free On Board
FOD	Field Operator Display
HMI	Human Machine Interface
HSE	Health Safety Environmental
HW	Hardware
I/A	Intelligent Automation
I/O	Input Output
IC	Initial Condition (file defining process state)
ICP	Installation and Check out Plan
ICT	Invensys Core Team

IET	Invensys Local EPC Team
IFA	Issued For Approval
IFAT	Integrated Factory Acceptance Test
IPS	Invensys Process Systems
ITP	Inspection and Test Plan
JER	Jubail Export Refinery
JEREP	Jubail export Refinery Engineering Procedures
JERES	Jubail Export Refinery Engineering Standards
JERMS	Jubail Export Refinery Materials Specifications
JSD	Job Specification Design
JSS	Job Specification Supply
KOM	Kick Off Meeting
LSZH	Low Smoke Zero Halogen
MCC	Motor Control Centre
MMS	Machine Maintenance System
MOM	Minutes of Meeting
MP	Main Processor
MTS	Maintenance Training System
MVT	OTS (Process) Model Validation Test
NCR	Non Conformance Report
NMR	Non Material Requisition
NTP	Network Time Protocol
OMM	Order Movement Management
OSBL	Out Side Battery Limits
OTS	Operator Training Simulator
OGC	Operator Group Console
P&ID	Process and Instrumentation Diagram
PAT	Performance Acceptance Test
PCS	Process Control System
PDR	Preliminary Design Review
PEFS	Process Engineering Flow Scheme
PFD	Process Flow Diagram
PLC	Programmable Logic Controller
PMT	Programme Management Team
QA	Quality Assurance
QC	Quality Control
SAT	Site Acceptance Test
SATORP	Saudi Aramco and Total Refinery and Petrochemical SATORP
SCADA	Supervisory Control And Data Acquisition

SCT	SATORP PCS Core Team
SDD	System Design Document
SDP	System Development Plan
SET	SATORP EPC Team
SIL	Safety Integrity Level
SOE	Sequence of Events
SRR	System Readiness Review
TCM	Triconex Communication Module
TGS	Tank Gauging System
TIS	Tank Information System
TMC	Turbo Machinery Control
TMR	Triple Modular Redundant
TQ	Technical Query
TR	Test Report
TRX	Triconex
UCP	Unit Control Panel
VMS	Vibration Monitoring System
WBS	Work Breakdown Structure

1 INTRODUCTION

1.1 Purpose and Scope

The purpose of this procedure is to provide guidance for EPC for the unpacking and installation of the SS 1608B supplied by the PCS Vendor prior to Site Acceptance Test.

This procedure does not cover equipment not supplied by the PCS Vendor but references these where required for proper operation of the SS 1608B.

1.2 Overview

The PCS Installation and Check out Procedure details information on inspection of packed PCS Equipment, handling of packed PCS Equipment, unpacking and handling of unpacked PCS Equipment, location and Installation of PCS Equipment and interconnection of PCS Equipment supplied by PCS Vendor and supplied by Others for SS 1608B.

All Shipments of SS 1608B shall be:

- Visual Inspected for damage to packaging during shipment and handling prior to unpacking
- Unpacked and Visually inspected for damage during shipment / handling.
- Cabinets and Consoles, placed at required location, assembled and installed / secured in place.
- Cabinets and Consoles grounded.
- Cables (Supplied by PCS Vendor) installed and routed in accordance with EPC design.
- Cables (Supplied by Others) installed and routed in accordance with EPC design.

1.3 Prerequisites

All packages of SS 1608B required for the installation shall have been received at site, checked against shipping documentation.

PCS Cabinets should only be unpacked within the final location after the building has reached its Ready for PCS Equipment milestone - building powered from UPS, HVAC operational and dust free.

Installation Site inspection to be completed to confirm that all work required to be completed prior to installation of PCS equipment is done, e.g. under floor cable tray installation, earth grid, cabinet console support frame complete and any cabling / other equipment required to be installed before PCS equipment is installed is completed.

Start up spares and test equipment available.

Other materials required but not supplied by PCS Vendor are available.

Installation and Check out Schedule completed by EPC.

Required personnel specified by EPC are available for the expected duration of the installation.

Safety Procedures in place and all personnel inducted and aware.

PCS Vendor As Built documentation for the SS 1608B available.

1.4 PCS Vendor Personnel and Responsibilities

Team Members responsibilities are as follows:

Team Member	Responsibilities
Project Manager	Overall responsibility for the Project.
Installation Supervisor	Installation Supervision. Focal point for installation issues.
Quality Manager (Part)	Responsible for ensuring the quality and handling quality related issues.
Installation Engineer(s)	PCS Vendor engineer for installation work, where required by EPC.
PCS Core Team	Technical Authority and Review of Global TRs

One team member may be allocated multiple duties as applicable.

1.5 EPC Personnel Requirements and Responsibilities

EPC shall assign the following personnel to the installation team.

Team Member	Responsibilities
Installation Supervisor	Responsible for the Installation on behalf of EPC An engineer with delegated approval authority on behalf of EPC. Responsible for the Installation and Check out Plan / schedule (ICP) Responsible for review and approval of Installation and Check out documentation. Responsible for Installation and Check out acceptance.
Package Inspector	Responsible for system hardware inspection.
Installation Engineer(s)	Responsible for the installation, testing, witnessing and participating in the installation and check out as directed by the respective Installation Supervisor

One team member may be allocated multiple duties as applicable.

Note: One of the above personnel must have authority for accepting the PCS system on behalf of the EPC designated approving authority, and shall be named prior to the installation phase commencing.

1.6 Installation and Check out Plan / Schedule

The project installation and check out phases will be detailed in the EPC Installation and Check out Plan / schedule (ICP). A detailed schedule will be provided, indicating required resource levels and parallel tasks being performed. PCS Vendor will provide indicative resource requirements against the EPC ICP during development, when requested by EPC.

1.7 Installation and Check out Documentation Sign Off

After completion of each installation and check out phase, the PCS Vendor and SATORP/EPCs engineers shall sign the appropriate sign-off sheet within the Installation and Check out Procedures document. Any supplementary literature – initialled Interface and Connection Schedules etc. shall be filed with the Installation and Check out procedure for future reference.

A Test Report (TR) database (System Log) shall be maintained by PCS Vendor during installation and check out. All problems that have occurred, equipment shortages, system deficiencies and other observations shall be recorded. Each TR shall be passed to the respective Installation Supervisor to decide on the corrective action. Signed off copies of the TR sheets and summary sheet shall be collated with the Test Procedures document for future reference. A sample Test Report sheet is provided in the appendices.

On completion of all tests, the SATORP/EPCs approving authorities will be required to sign-off the Installation and Check out Completion Certificate, subject to any TRs.

1.8 Installation and Check out Completion

On completion of the installation and check out, the SATORP/EPCs approving Engineers will sign a Completion of Installation Certificate. Any outstanding non-conformance will be recorded on this certificate, with a view to completion within an agreed period.

2 UNPACKING AND HANDLING

PCS Cabinets should only be unpacked within the final location after the building has reached its Ready for PCS Equipment milestone - building powered from UPS, HVAC operational and dust free.

Prior to unpacking the packaging should be inspected as detailed in Section 3 VISUAL CHECKS

All PCS equipment is palletised, secured to a properly designed wooden skid to facilitate material handling by mechanized equipment, sealed with moisture protection, and contained within wooden crating using plywood of sufficient strength and thickness. A barrier material (either polythene sheet or aluminium foil) is used for protection against ingress of dirt, moisture and sea / rain water during transit. Bags of silica-gel are provided as a moisture absorbing agent. In addition vacuum sealing is used to provide additional protection of the sensitive or system products contained therein.

All pallets can be bottom lifted by fork lift or pallet truck, or top lifted with the aid of slings and spreader bars by fork lift or crane. All lifting should be carried out by qualified personnel using appropriate equipment. No lifting equipment is supplied by PCS Vendor.

It is recommended that heavy equipment such as cabinets should be moved close to their final location to avoid carrying the equipment far once unpacked.

Unpacking is a reversal of the packing process detailed in the Packing and Preservation Procedure, SA-JER-IPAAA-INVE-500001.

Note the crate is constructed using nails and care should be taken when disassembling the crate to avoid personal injury or damage to the materials inside the crate. Disassembly should only be carried out on a clear level surface.

The steel straps should be removed first, with the top section of the box removed afterwards. Any horizontal chocks at the top of the packaged should then be removed, followed by the sides (walls) of the crate. Large items such as cabinets will also have additional chocks fitted at the base, pallet. These should be removed before lifting the cabinet off the pallet.

The sealed moisture protective barrier should then be removed; care should be taken when using blades to cut open the aluminium foil or polythene sheet, so as not to damage the material inside. Additional plastic coverings / shrink wrap can then be removed.

Equipment / Cabinets / Boxes can then be opened and the (moisture absorbing agent) Silica Gel bags removed. The Silica Gel bags should be inspected for signs of excessive exposure to moisture and any such signs noted should result in a more detailed inspection of the packaging and equipment.

After unpacking, the equipment should be inspected against the packing list and drawings as detailed in Section 3 VISUAL CHECKS

Cabinets / Cabinet suites are fitted with lifting eyes or brackets to enable top lifting into the cabinet's final position.

All packaging should be disposed of or recycled in an environmentally friendly way.

3 VISUAL CHECKS

Objective Outline:

The purpose of this inspection is to ensure that all SS 1608B supplied by PCS Vendor is available on site and has not been damaged in transit.

Criteria:

There should not be any external defects such as damaged and broken packaging that would indicate abuse or mishandling during transit and storage before installation. Any shock, tilt indicators or Temperature Strips fitted should be checked.

The unpacked equipment should not have any external defects such as deformities / scratches that might impair the product quality or appearance and all items must be labelled properly for easy identification.

Cabinets should be opened to confirm the internal equipment has not moved during shipping.

Procedure:

Visually inspect all packages to ensure that all packages identified on the shipping documentation are present and are free from signs of damage or mishandling. Record results in APPENDIX C – VISUAL INSPECTION CHECKLISTS

Visually inspect each item when unpacked items against the packing lists to confirm that all equipment detailed is present and free from defects. Check Silica Gel packets for signs of excessive exposure to moisture. Record results in APPENDIX C – VISUAL INSPECTION CHECKLISTS.

Cabinets doors should be opened to confirm proper operation and that the internal equipment has not moved during shipping using the General Arrangement Drawing. Record results in APPENDIX D – CABINET VISUAL INSPECTION CHECKLISTS.

Visual Check		
PASS/FAIL CRITERIA		Comments
All packages reference in shipping documentation inspected for damage.	<input type="checkbox"/>	
All items in packages reference in packing list inspected for damage	<input type="checkbox"/>	
Check sheets in Appendix C completed for all packages	<input type="checkbox"/>	
All cabinets internal arrangement checked against As Built General Arrangement Drawings Check sheets in Appendix D completed for all cabinets	<input type="checkbox"/>	

Visual Checks

A: System Identification

DCS Area	:	DCS Area 3
Location	:	SS 1608B

B: Reference Documents

Title	Invensys Document No.	Revision No / Date
Shipping Documentation	Refer to Appendix B	
Packing List	Refer to Appendix B	
General Arrangement Drawing	Refer to Appendix D	

C: Inspected

Inspected By (Invensys personnel):

Print Name	Signature	Date DD/MM/YY

D: Comments

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E: SATORP Witness

Witnessed By (SATORP personnel):

Print Name	Signature	Date DD/MM/YY

F: EPC Acceptance

Accepted By (EPC personnel):

Print Name	Signature	Date DD/MM/YY

4 CABINET / CONSOLE INSTALLATION

4.1 Location of Cabinets Consoles

For PCS equipment locations refer to the building equipment room layout drawing supplied by others,

Once cabinets are located into there final position, they should be secured either to the adjacent cabinet by means of cabinet baying kits (supplied by others) or to the cabinet support frame in the false floor or both.

Consoles should be assembled in there final location (refer to assembly instructions provided by Evans), the console bays connected together and then secured to the console support frame in the false floor.

4.2 Grounding of Cabinets Consoles

After securing the cabinets / console each cabinet / console bay should then be connected to the earth grid via two (2) LSZH earth cables, 35mm² minimum Green / Yellow, supplied by others.

Prior to connecting AC power cables to these PCS equipment the grounding should be verified as detailed in Section 5 EARTH BONDING CHECKS

4.3 Re-installation of shipping break cablings

24Vdc power cables and signal wiring between cabinets shipped separately are coiled within the separate cabinet shipping sections.

This wiring should be re-routed through the shipping breaks and reconnected. The wiring between these cabinets should be checked for continuity and the test recorded on the As Built Wiring drawings for the respective equipment. Refer to Section 6 ELECTRICAL WIRING CHECKS

5 EARTH BONDING CHECKS

WARNING: Ensure Cabinet is not powered ON and/or connected to any AC input power prior and through out the entire verification inspection stipulated below

Note:

The earth bonding tests are electrical safety tests carried out prior to powering up the system as such these tests shall be completed before applying power to the systems.

Objective Outline:

The purpose of this test is to ensure proper earth connection prior to power on. All earth connections are in accordance with the specifications and approved PCS Vendor / EPC drawings and documents.

Criteria:

The Earth connection should be proper prior to power on of the cabinets. Safety Ground (SG) conductivity test values are recorded. This completion of these tests should be document by the EPC. All cabinet metalwork earth resistance to building safety ground point has resistance $\leq 1\Omega$.

Test Procedure:

This test procedure is defined by EPC and may be a complete test of all the cabinet metalwork to the building main earth point or individual tests of the separate parts of the earth path to this point.

PCS Vendor testing already confirms that the resistance from any part of the equipment to the equipment safety ground bars is $< 0.1\Omega$.

EPC testing of the earth grid within the building should already have been conducted to document the resistance of any part of the earth grid to the main earth point in the building.

EPC testing of the earth connection from the PCS equipment Safety Ground earth bars to the earth grid or the main earth point in the building should confirm the criteria above has been met.

Record the maximum resistance for each cabinet in APPENDIX E – EARTH CONDUCTIVITY CHECKLIST

Test equipment is supplied by others.

Earth Conductivity Checks

A: System Identification

DCS Area	:	DCS Area 3
Location	:	SS 1608B

B: Reference Documents

Title	Document No.	Revision No / Date
PCS FAT Records	<Insert Document Number Here>	Rev XX
EPC Earth Conductivity Test Records	<Insert Document Number Here>	Rev XX

C: Verified

Verified By (Invensys personnel):

Print Name	Signature	Date DD/MM/YY

D: Comments

E: SATORP Witness

Witnessed By (SATORP personnel):

Print Name	Signature	Date DD/MM/YY

F: EPC Acceptance

Accepted By (EPC personnel):

Print Name	Signature	Date DD/MM/YY

6 ELECTRICAL WIRING CHECKS

Objective Outline:

The purpose of this test is to ensure that all electrical wiring that was disconnected for shipping purposes has been re-installed correctly in accordance with the Cabinet Wiring drawings

Criteria:

All electrical wires should be routed correctly ensuring required segregation criteria are met and connectivity is as per Cabinet Wiring Drawing referenced in APPENDIX F – SHIPPING BREAK WIRING DRAWINGS

Test Procedure:

Visual inspection is completed before electrical connectivity tests are carried out. Connectivity is checked using a continuity tester against the Cabinet Wiring Drawings referenced in APPENDIX F – SHIPPING BREAK WIRING DRAWINGS. All wires shall be marked off as checked on these Cabinet Wiring Drawings.

Shipping Break Electrical Wiring Checks		
PASS/FAIL CRITERIA		Comments
Check cabinet wiring segregation is as specified in the Cabinets FDS.	<input type="checkbox"/>	
Check cabinet wiring as in Appendix F	<input type="checkbox"/>	

Electrical Wiring Checks

A: System Identification

DCS Area	:	DCS Area 3
Location	:	SS 1608B

B: Reference Documents

Title	Invensys Document No.	Revision No
PCS Cabinets FDS	2271-PCS-FDS-002	Rev XX
PCS Cabinet Wiring Drawings	Refer to Appendix F	

C: Tested

Tested By (Invensys personnel):		
Print Name	Signature	Date DD/MM/YY

D: Comments

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E: SATORP Witness

Witnessed By (SATORP personnel):		
Print Name	Signature	Date DD/MM/YY

F: EPC Acceptance

Accepted By (EPC personnel):		
Print Name	Signature	Date DD/MM/YY

7 CABLE INSTALLATION

7.1 Fibre Optic Multicore Cable Installation

Fibre Optic Multicore cables between buildings are installed, terminated by EPC on patch panels (supplied by PCS Vendor) and tested to ensure proper connectivity.

Cables between PCS Communications cabinets in MCB and PCS switch cabinets in PIBs (ISBL) are by EPC5A.

Cables between PCS switch cabinets in PIB and PCS switch cabinets in Substations are by EPC.

Cables between PCS switch cabinets in PIB and PCS switch cabinets in Port FCR are by EPC 8.

Cables between PCS switch cabinets in FCR and PCS switch cabinets in Berths are by EPC 9.

Cables between PCS CCTV cabinets and Cameras are by EPC.

EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation.

7.2 Fibre Optic Patch Cable Installation

LSZH Fibre Optic Patch Cables between cabinets in individual buildings, these are normally supplied by EPC, but may be supplied by PCS Vendor in some instances. Refer to the System Cable schedule for details of Scope of supply and list of cables.

EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation.

Note: These cables may be tested as part of SAT.

7.3 Ethernet CAT6 Cable Installation

LSZH CAT6 Ethernet Cables between cabinets in individual buildings, these are normally supplied by EPC, but may be supplied by PCS Vendor in some instances. Refer to the System Cable schedule for details of Scope of supply and list of cables.

EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation.

Note: These cables may be tested as part of SAT.

7.4 Serial Interface Cable Installation

LSZH RS485 Cables between cabinets in DCS system cabinets and 3rd Party packages are normally supplied by EPC, but may be supplied by PCS Vendor in some instances. Refer to the System Cable schedule for details of Scope of supply and list of cables.

EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation.

Note: These cables may be tested as part of SAT.

7.5 System Cable Installation

All System cables are supplied by PCS Vendor. These cables are between IO modules in system cabinets and Termination Assemblies in Marshalling Cabinets. Refer to the System Cable schedule for details of Scope of supply and list of cables.

EPC installation is to be verified against the As Built Interconnecting Block Diagram and the System Cable Schedules to confirm correct installation.

Note: These cables are tested as part of SAT.

7.6 AC Power Cable Installation

120Vac power cables between cabinets are supplied, installed and tested by EPC.

Cables between Electrical Distribution Panels in EPC scope and PDC cabinets not detailed on the Interconnecting Block Diagram, but are referenced on the PDC Wiring Drawing.

Cables between PDC and Field Equipment are shown on the Interconnecting Block Diagram, and are referenced on the PDC Wiring Drawing.

Cables between PDC and Local Cabinets within the building are shown on the Interconnecting Block Diagram, and are referenced on the PDC Wiring Drawing.

All PCS Equipment shall have the 120V ac input MCBs in the OFF position for all Isolation testing carried out by EPC. Refer to Section 8 120V ac DISTRIBUTION INSULATION CHECKS

All PCS Equipment shall have the 120V ac input MCBs in the OFF position for all Power On distribution testing carried out by EPC. Refer to Section 9 POWER ON CHECKS

7.7 Multicore Cable Installation

All Multicore Cables are supplied, installed and tested by EPC.

All Multicore cables (with the exception of MMS cables and Thermocouple cables) are terminated on disconnect terminals by EPC, all disconnect terminals shall remain open until loop checking is completed.

WARNING: Care should be taken during loop testing to ensure that Multicore Wiring terminated without disconnect terminals are not exposed to voltage levels that could damage the PCS equipment.

Multicore cables between PCS cabinets are to be loop tested during SAT. This includes diagnostic signal cables and cables between marshalling cabinets and between marshalling cabinets and Interposing Relay Cabinets (IRC) in Substations.

Cable Installation Checks		
PASS/FAIL CRITERIA		Comments
FO Multicore Cable Installation EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation	<input type="checkbox"/>	
FO Patch Cable Installation EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation	<input type="checkbox"/>	
Ethernet CAT6 Cable Installation EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation	<input type="checkbox"/>	
Serial Interface Cable Installation EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation	<input type="checkbox"/>	
System Cable Installation EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation	<input type="checkbox"/>	
AC Power Cable Installation EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation	<input type="checkbox"/>	
Multicore Cable Installation EPC installation and test records are to be verified against the As Built Interconnecting Block Diagram to confirm correct installation	<input type="checkbox"/>	

Cable Installation Checks

A: System Identification

DCS Area	:	DCS Area 3
Location	:	SS 1607

B: Reference Documents

Title	Invensys Document No.	Revision No
PCS Cable Schedules	SA-JER-PIAAA-PIXJ-380202	Rev 03
PIB/SS Interconnecting Block Diagram	SA-JER-PIAAA-PIXJ-060201	Rev 03

C: Tested

Tested By (Invensys personnel):

Print Name	Signature	Date DD/MM/YY

D: Comments

E: SATORP Witness

Witnessed By (SATORP personnel):

Print Name	Signature	Date DD/MM/YY

F: EPC Acceptance

Accepted By (EPC personnel):

Print Name	Signature	Date DD/MM/YY

8 120V ac DISTRIBUTION INSULATION CHECKS

WARNING: Ensure all Electrical / Electronic equipment that may be damaged by connection to High Voltages. For Example: Field Instruments, Field PSU, Tricon PSU, Tricon Modules, ETA's, PC's, Network Switches, Relays, Barriers etc are isolated from the circuits being tested. Check using Digital Multimeter that there is an open circuit between points being tested prior to insulation tests. Using 500V insulation tester check that insulation resistance is >10 MΩ between:

Note:

The isolation tests are electrical safety tests carried out prior to powering up the system as such EPC shall complete the above tests during installation phase.

Objective Outline:

The purpose of this test is to ensure proper isolation between separate Power Circuits and Safety Ground prior to power on. All AC supply and earth connections are in accordance with the specifications and approved PCS Vendor drawings and documents.

Criteria:

The Earth connection should be proper prior to power on of the cabinets. Power/Earth isolation check conducted and results are recorded by EPC

Test Procedure:

For isolation check between AC Supplies (Live and Neutral) and AC Supplies and Safety Ground (Live and Safety Ground, and Neutral and Safety Ground).

Test Record:

This test procedure and record is defined by EPC. Test Equipment is supplied by others.

120Vac Distribution Insulation Checks		
PASS/FAIL CRITERIA		Comments
EPC Insulation test records are to be verified.	<input type="checkbox"/>	

120Vac Insulation Checks

A: System Identification

DCS Area	:	DCS Area 3
Location	:	SS 1608B

B: Reference Documents

Title	Document No.	Revision No / Date
PCS PDC Wiring Drawings	SA-JER-PIAAA-PIXJ-750208	Rev 03
PIB/SS Interconnecting Block Diagram	SA-JER-PIAAA-PIXJ-060201	Rev 03
EPC 120V ac Isolation Test Records	<Insert Document Number Here>	Rev XX

C: Verified

Verified By (Invensys personnel):

Print Name	Signature	Date DD/MM/YY

D: Comments

E: SATORP Witness

Witnessed By (SATORP personnel):

Print Name	Signature	Date DD/MM/YY

F: EPC Acceptance

Accepted By (EPC personnel):

Print Name	Signature	Date DD/MM/YY

9 POWER ON CHECKS

WARNING: Confirm that all the un-powered tests in previous sections have been completed before proceeding with the powered tests.

Perform the following tests with reference to the cabinet wiring drawing.

Objective Outline:

The purpose of this test is to ensure the Power Distribution is functionally ok and are in accordance with the As Built PCS Vendor documents.

Criteria:

All prior tests shall have been completed prior to connection of ac supplies to the cabinet. The power connection should be proper prior to power on the cabinets.

Test Procedure:

The following test is to ensure proper power feed is connected to the system prior to power on.

1. Check All PDC MCBs are in OFF position.
2. Check all Cabinet MCBs are in OFF position
3. Check 120V AC supplies to incoming AC supply terminals / MCB is available when the correct PDC MCB is switched ON
4. Mark off each tested PDC MCB on the As Build PDC wiring drawing.

Power On Checks		
PASS/FAIL CRITERIA		Comments
Check 120V AC supplies to incoming AC supply terminals / MCB when supplying PDC MCB is turned ON.	<input type="checkbox"/>	

Power On Checks

A: System Identification

DCS Area	:	DCS Area 3
Location	:	SS 1608B

B: Reference Documents

Title	Invensys Document No.	Revision No
PCS PDC Wiring Drawings	SA-JER-PIAAA-PIXJ-750208	Rev 03
PIB/SS Interconnecting Block Diagram	SA-JER-PIAAA-PIXJ-060201	Rev 03

C: Tested

Tested By (Invensys personnel):		
Print Name	Signature	Date DD/MM/YY

D: Comments

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E: SATORP Witness

Witnessed By (SATORP personnel):		
Print Name	Signature	Date DD/MM/YY

F: EPC Acceptance

Accepted By (EPC personnel):		
Print Name	Signature	Date DD/MM/YY

10 COMPLETION OF INSTALLATION CERTIFICATE

DCS Area DCS Area 3

Location: SS 1608B

Test Details

Installation Location:

Installation Start Date

Installation Completion Date:

Upon completion of the test.

- ☐ Ensure all master Invensys drawings / documents are marked up and are ready for redrafting
- ☐ Ensure all punch list items are either closed or transferred to the exception list
- ☐ Ensure SATORP/ EPC have signed off on Installation Report and Installation Certificates
- ☐ Ensure all design input documents are marked up and copied. Attach signed Installation Certificates.

Completion of Installation Certificate

COMMENTS: _____

WITNESSED BY : _____

Invensys

SATORP

EPC

DATE : _____

APPENDIX A – TEST REPORT

TR Number: _____ Unit: _____ Delete: *Installation and Check out*

Originator _____ Date: _____

1) Fault/Issue Found

2) Action Required

3) Test to be Performed

4) Action Taken

Feedback to Engineering Team: Yes / No By: _____ Date: ____/____/____

PCS System Affected: (Tick One) TMR : <input type="checkbox"/> ESD <input type="checkbox"/> F&G <input type="checkbox"/> CCS <input type="checkbox"/> BMS <input type="checkbox"/> Safety PLC Others : <input type="checkbox"/> DCS <input type="checkbox"/> ECS <input type="checkbox"/> MMS <input type="checkbox"/> CCTV <input type="checkbox"/> OTS	Fault/Issue: (Tick One) <input type="checkbox"/> System Hardware <input type="checkbox"/> Cabinets <input type="checkbox"/> Cables <input type="checkbox"/> Graphic <input type="checkbox"/> Function Blocks <input type="checkbox"/> Logic/Control Narrative <input type="checkbox"/> Alarms <input type="checkbox"/> Database	Fault Due To: (Tick One) EPC <input type="checkbox"/> Change SATORP <input type="checkbox"/> Change Invensys <input type="checkbox"/> Change <input type="checkbox"/> Error <input type="checkbox"/> Product Issue	Importance: (Tick One) <input type="checkbox"/> Global Impact <input type="checkbox"/> EPC Interface Issue <input type="checkbox"/> Both of the Above
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Corrected by Invensys: TQ Ref: _____ Date: ____/____/____	Checked by Invensys: _____ ** Invensys Safety Authority: _____ Date: ____/____/____	Accepted by EPC: _____ Date: ____/____/____	Witnessed / Accepted by SATORP : _____ Date: ____/____/____
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**** Invensys Safety Authority to Check ALL TMR System Test Reports.**

APPENDIX B – PCS EQUIPMENT SHIPPING DOCUMENTS

APPENDIX D – CABINET VISUAL INSPECTION CHECKLISTS

[illegible]

APPENDIX E – EARTH CONDUCTIVITY CHECKLIST

Safety Ground Conductivity Tests

Check that the Safety Ground Conductivity Tests have been completed and the results documented by the EPC confirmed that the total resistance between all Metalwork to Building Main Safety Ground (SG) bar is $\leq 1 \Omega$.

[illegible]

APPENDIX F – SHIPPING BREAK WIRING DRAWINGS